Amendments to the Claims:

Claims 1 – 47 cancelled

48. (Currently Amended) An optical system for *in vivo*, non-invasive imaging of biological tissue comprising:

a stimulator constructed and arranged to stimulate cognition in a subject;

~~a spectrophotometer co-operatively arranged with said stimulator;~~

an optical module constructed to provide a multiplicity of arrayed source-detector pairs constructed for direct engagement with a forehead of the subject; said source-detector pairs being formed by at least one **[[**a**]]** light source constructed to introduce electromagnetic radiation of a visible or infra-red wavelength into biological tissue and at least one **[[**; a**]]** light detector constructed to detect optical radiation that has migrated in the tissue being imaged, and said optical modules being constructed for detection of said radiation having migrated in a prefrontal cortex upon said engagement with the forehead; and

a processor constructed and arranged to control operation of said optical module and said stimulator, said processor being coupled to receive signals of said detected radiation after migration in the prefrontal cortex ~~from said light detector~~, and being constructed and arranged to create a defined spatial image of the tissue by effectively producing image data corresponding to differences between two data sets of the tissue being stimulated and the tissue not being stimulated by said stimulator.

49. (Currently Amended) The optical system of claim 48 wherein said optical module is constructed to provide to said processor said signals corresponding to one said wavelength of said radiation ~~to prevent migration of superficial photons migrating on a tissue surface~~.

50. (Currently Amended) The optical system of claim 48 wherein said optical module is constructed to provide to said processor said signals corresponding to two said wavelengths of said radiation ~~be positioned on the exterior surface of the head~~

~~and also constructed to prevent migration of superficial photons migrating on a tissue surface~~.

51. (Currently Amended) The optical system of claim 48 wherein said optical module including said arrayed source-detector pairs are constructed to include one said light detector located symmetrically with respect to at least two of ~~several~~ said light sources for providing the respective source-detector pairs.

52. (Original) The optical system of claim 48 wherein said optical module is constructed to maintain a selected distance between said source-detector pairs during the production of said data sets, said distance being selected according to the tissue depth desired to be imaged.

53. (Original) The optical system of claim 52 wherein said processor is constructed to produce 2D data for said tissue depth.

54. (Original) The optical system of claim 52 wherein said processor is constructed to produce 3D data sets from which said image data set, related to said differences, is produced.

55. (Original) The optical system of claim 48 wherein said processor calculates said image data set by implementing an optical tomography algorithm.

56. (Original) The optical system of claim 55 wherein said optical tomography algorithm employs factors related to determined probability distribution of photons attributable to the scattering character of the tissue being imaged.

57. (Original) The optical system of claim 48 wherein said optical module including said arrayed source-detector pairs are constructed for imaging of frontal tissue of the head.

58. (Original) The optical system of claim 48 wherein said optical module including said arrayed source-detector pairs form a symmetrical pattern.

59. (Original) The optical system of claim 48 wherein said image set is created from data related to at least one of the group consisting of: blood volume, hemoglobin oxygenation, hemoglobin deoxygenation, photon absorption coefficient, photon scattering coefficient, and refractive index.

60. (Original) The optical system of claim 48 including optical fibers for coupling light between the examined tissue and said light source and detector.

61. (Original) The optical system of claim 48 in which each source is laterally displaced from said respective detector on the surface of a subject at a side by side spacing between about 1.5 and 7 cm to establish a banana-shaped probability distribution of migrating photons in the examined tissue.

62. (Currently Amended) An instrument for functional imaging of brain activity of a subject, comprising

a stimulator constructed and arranged to stimulate a cognitive activity; and

an imager constructed and arranged to image optical data related to hemoglobin, deoxyhemoglobin or blood volume, said imager comprising an array of sources for emitting a near infrared or visible wavelength into brain tissue, an array of detectors positioned to receive photons of said wavelength that have migrated from the sources inside the tissue, and said sources and detectors being arranged to direct said photons to and receive said photons from a prefrontal cortex of a subject;

a system enabling numerous readings of migrated photons to be taken systematically for different source-detector positions relative to the tissue, and

a processor employing data sets taken to create a defined spatial image of the tissue using multiplicity of arrayed source-detector pairs providing optical signal of the tissue being stimulated and the tissue not being stimulated by said stimulator.

63. (Currently Amended) A method of *in vivo*, non-invasive imaging of tissue change related to cognition, comprising:

providing a stimulator constructed and arranged to stimulate a cognitive activity of a subject;

providing an array of input locations and detection locations arranged over a selected geometrical pattern ~~to provide a multiplicity of photon migration paths in brain tissue~~,

introducing electromagnetic radiation of a visible or infra-red wavelength into **[[**the**]]** brain tissue selectively at said input locations, said wavelength being sensitive to a constituent of the tissue, said geometrical pattern defining a multiplicity of photon migration paths in a prefrontal cortex of the subject;

detecting, at said detection locations, radiation of said selected wavelength that has migrated in the tissue of the prefrontal cortex from at least one input location;

stimulating a cognitive activity of the subject;

repeating said introduction and detection while stimulating said cognitive process; and

creating a defined spatial image of the tissue of the prefrontal cortex based on signals from said multiplicity of said photon migration paths detected for brain tissue being stimulated and brain tissue not being stimulated.

64. (Original) The imaging method of claim 63 including detecting radiation for a selected input and detection separation to produce 2D data sets.

65. (Original) The imaging method of claim 63 including detecting radiation for different input and detection separation to produce 3D data sets.

66. (Original) The imaging method of claim 63 further including calculating said image related to at least one of the group consisting of: blood volume, hemoglobin oxygenation, hemoglobin deoxygenation.

67. (Original) The imaging method of claim 63 further employing a second wavelength.

68. (Currently Amended) The imaging method of claim 63 further including introducing an optical contrast agent to the blood stream of the subject, and

producing ~~said~~ image data sets of said defined spatial image for the tissue while the contrast agent is present in the blood circulating in the tissue of the subject.

69. (Currently Amended) The imaging method of claim 63 further including introducing a drug to the blood stream of the subject, and

producing ~~said~~ image data sets of said defined spatial image for the tissue while the drug is present in the blood circulating in the tissue of the subject.

70. (Original) The imaging method of claim 63 wherein said stimulating includes displaying words to the subject.

71. (Original) The imaging method of claim 63 wherein said stimulating includes displaying words to the subject for the purpose of translating said displayed words from one language to another.

72. (Original) The imaging method of claim 63 wherein said stimulating includes providing signals for the subject to displace a body part.

73. (Original) The imaging method of claim 63 wherein said stimulating includes providing signals for the subject for initiating finger tapping.

74. (Currently Amended) The imaging method of claim 63 ~~64 wherein said imaging includes imaging~~ including treating the subject based on said images of the cognitive activity in the prefrontal cortex of the subject.

75. (Original) The imaging method of claim 74 wherein said stimulating includes displaying words to the subject for the purpose of translating said displayed words from one language to another.

76. (Original) The imaging method of claim 74 wherein said creating said defined spatial image includes calculating a blood volume.

77. (Original) The imaging method of claim 74 wherein said creating said defined spatial image includes calculating hemoglobin oxygenation.

78. (Original) The imaging method of claim 74 wherein said creating said defined spatial image includes calculating hemoglobin deoxygenation.

79. (Original) The instrument of claim 62 wherein said stimulator includes a display.

80. (Original) The instrument of claim 79 wherein said display is constructed to display words to a subject.

81. (Original) The instrument of claim 62 wherein said stimulator is constructed to generate sound.

82. (Original) The instrument of claim 62 wherein said stimulator is constructed to generate vibrations.

83. (Currently Amended) The instrument of claim 62 **[[**79**]]** wherein said imager is constructed to provide said images for diagnosis of the subject. ~~image the cognitive activity in the prefrontal cortex of the subject~~.

84. (Original) The instrument of claim 62 wherein said processor is constructed to calculate a blood volume.

85. (Original) The instrument of claim 62 wherein said processor is constructed to calculate hemoglobin oxygenation.

86. (Original) The instrument of claim 62 wherein said processor is constructed to calculate hemoglobin deoxygenation.